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Untested, Unsafe? Cannabis Users Show Higher Lead and Cadmium Levels

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Cannabis belongs to a class of plants known as hyperaccumulators[1,2] because their tissues can accumulate metals from soil, water, fertilizers, and other sources at levels hundreds or thousands of times greater than is normal for most plants. Cannabis cultivars grown for fiber, commonly called hemp, may even be planted strategically to remove toxic metals from soil.[1–3] Yet this same property represents a potential health risk in cannabis plants grown for human consumption, also called marijuana, whether through smoking or concentration in edibles and other products. Now, a large new cross-sectional study in *Environmental Health Perspectives*[4] reports evidence of associations between self-reported marijuana use and markers of both lead and cadmium in the body.

Researchers with Columbia University reviewed data from the National Health and Nutrition Examination Survey (NHANES) between 2005 and 2018 representing 7,254 participants who completed a drug use questionnaire and provided single samples of blood and urine. In their analysis, the researchers adjusted for factors that may affect exposure to metals and their excretion. These included race/ethnicity, age, sex, education, tobacco use, and seafood consumption.

They found that survey participants who reported using marijuana but no tobacco in the previous 30 days had higher levels of cadmium and lead in their blood and urine than did those who had used neither marijuana nor tobacco. Users had cadmium levels on average 22% higher in blood and 18% higher in urine than nonusers. Lead levels were higher by 27% in blood and 21% in urine. None of the 15 other elements evaluated—including arsenic, cobalt, manganese, mercury, and uranium—showed a clear association with cannabis use.

Human metabolism and excretion of metals varies widely, says senior author Tiffany Sanchez, an assistant professor of environmental health sciences at Columbia University.[5] With cadmium, blood levels generally reflect recent exposure, while urinary levels reflect chronic exposure, she says. "For lead, blood is used more often than urine as a biomarker of exposure, and it is a relevant proxy for studying health effects."

Both lead and cadmium can have harmful effects in humans at very low concentrations.[6,7] The U.S. Environmental Protection Agency considers any lead exposure to be dangerous[8] and has classified cadmium as a probable human carcinogen.[9]

Cannabis is one of more than 700 hyperaccumulators of metals—from soils, water, fertilizers, or pesticides—that have been identified to date,[19] along with barley,[20] sunflowers,[21] and tobacco.[22] Image: © iStock.com/AlenaPaulus.

The study stands out as one of very few to date to look at real-world associations between cannabis use and exposure to environmental contaminants, says Maxwell Leung, an assistant professor of pharmacology and toxicology at Arizona State University who was not affiliated with the research. "They were able to tease out the background exposure through other factors and find an association between cannabis use and those two metals," he says. "It's a tremendous contribution to our understanding of this public health issue."

Still, the relevance of the findings to current exposures is unclear, he notes, because the study period represents a time when far fewer Americans had access to cannabis that had been screened for safety by a certified testing lab. Over the last 5 years, the situation has changed dramatically. Today, almost half of Americans live in states where cannabis is not only legal for recreational use[10] but subject to lab testing for the presence of pesticides, mold, and other common contaminants—including lead and cadmium.[11,12] That said, consumers do not always buy from sanctioned sources that test their products,[13] and even in some locales where marijuana is legal, the illicit market still dominates.[14]

Rules for pesticide and microbial testing vary widely among states with legal markets, whereas metals are managed more consistently.[15,16] In many jurisdictions, including California—the nation's largest legal marijuana market since sales began in January 2018—smokable cannabis flower must contain less than 0.5 ppm lead and 0.2 ppm cadmium.[17] California rules require that flower failing to meet this or any other criterion must be destroyed or remediated (often through conversion to edible form through an extraction process that does not transfer contaminants).[18]

The study's dataset represents predominately nonregulated use, agrees Amber Wise, who was not affiliated with the research and serves as scientific director of Washington State commercial cannabis testing lab Medicine Creek Analytics. "I'm cautiously optimistic that more safety checks and more quality-control testing would reduce this [exposure] over time for cannabis users," she says. Indeed, researchers have suggested that consistent national regulation of contaminants in cannabis, still an illicit substance at the federal level, has the potential to reduce public health risks.[15]

Although the NHANES data were not stratified by state, future research using other data sources could begin to probe for differences in metal exposures among cannabis users in states with cannabis contaminant testing versus those without, says Sanchez. "It would be very interesting to see how legal status of cannabis affects metal levels in different states, and how that is also reflected in humans, in consumers—do they have different levels?"

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